Open Education for an Open World

Charles M. Vest
President, National Academy of Engineering
President Emeritus, MIT

Cambridge, Massachusetts
May 25, 2010
Salute to Dick Larsen

Richard Larsen, Founder
Salute to Dick Larsen

Richard Larsen, Founder

MIT LINC Consortium
Salute to Dick Larsen

Richard Larsen, Founder

MIT LINC

Consortium

Hero
Four Great Thoughts that shaped my views on Education
An uncommon education for the common man

James Burrell Angell
President University of Michigan
1871-1909
New frontiers of the mind are before us, and if they are pioneered with the same vision, boldness, and drive with which we have waged this war we can create a fuller and more fruitful employment and a fuller and more fruitful life.

President Franklin D. Roosevelt to Vannevar Bush
November 17, 1944
If ability, and not the circumstance of family fortune, determines who shall receive higher education, then we shall be assured of constantly improving quality at every level of scientific activity.

Vannevar Bush to President Harry S. Truman
July 5, 1945
May we now use every ability we have to communicate to build a society in which mutual respect, understanding and peace occur at all scales, between people, and between nations.

Sir Tim Berners-Lee
Japan Prize Lecture
2002
A Changing World
Global R&D Investments
R&D Expenditures and Share of World Total

Data for 2002
World total = $813

NOTES: R&D estimates from 91 countries in billions of purchasing power parity dollars. Percentages may not add to 100 because of rounding.

Source: Science and Engineering Indicators, NSF 2008
New Players

Where the Expertise is

Young Professional Workforce
(college grad up to 7 yr. experience)

Source: Competitiveness Index 2007, Council on Competitiveness, Washington, DC
First Engineering Degrees

(China Rises)

Source: NSF Science and Engineering Indicators 2010
First Engineering Degrees
(China Rises)

First Engineering Degrees (thousands)

Source: NSF Science and Engineering Indicators 2010
R&D Investment and Scientific, Engineering, and Business Talent are spreading around the Globe.
R&D Investment and Scientific, Engineering, and Business Talent are spreading around the Globe.

People everywhere are smart and capable.
R&D Investment and Scientific, Engineering, and Business Talent are spreading around the Globe.

People everywhere are smart and capable.

Are research universities globalizing?
Globalization of Research Universities

Phase I: Diffusion
Research University
Globalization Phase I

Germany
Humboldt University
1800s
Research University
Globalization Phase I

Germany
Humboldt University
1800s

USA
Johns Hopkins
1800s
Research University Globalization Phase I

Germany
Humboldt University
1800s

USA
Johns Hopkins
1800s

Berkeley, Stanford, Michigan, UC, …
1800s /1900s

MIT, Caltech, RPI, …
1800s / 1900s
Research University Globalization Phase I

- **Germany**
  - Humboldt University
  - 1800s

- **USA**
  - Johns Hopkins
  - 1800s

- **USA**
  - Berkeley, Stanford, Michigan, UC, ...
  - 1800s / 1900s

- **USA**
  - MIT, Caltech, RPI, ...
  - 1800s / 1900s

- **2000s!**
Research University Globalization Phase I

- **Germany**
  - Humboldt University
    - 1800s

- **USA**
  - Johns Hopkins
    - 1800s

- **Berkeley, Stanford, Michigan, UC, ...**
  - 1800s / 1900s

- **MIT, Caltech, RPI, ...**
  - 1800s / 1900s

- **2000s!**

- **IITs India**
  - 1960's

- **Acceleration Asia, Middle East**
  - 2000's

- **Bologna Europe**
  - 2010
Which University will be the Global University of the 21st century?
Which University will be the Global University of the 21st century?

Wrong Question
Globalization of Research Universities

Phase II: Cooperation & Openness
Research University
Globalization Phase II

• Physical Presence in Other Countries
  – Campuses
  – Laboratories
Research University
Globalization Phase II

• Physical Presence in Other Countries
  – Campuses
  – Laboratories

• Strategic Alliances Between Universities
Research University Globalization Phase II

• Physical Presence in Other Countries
  – Campuses
  – Laboratories

• Strategic Alliances Between Universities

• Virtual Presence in Other Countries
  – Distance Education
    • Synchronous
    • Asynchronous
  – Open Content: The Emerging Meta-University
    • Teaching Materials
    • Scholarly Archives
    • Telepresent Laboratories
Research University
Globalization Phase II

• Physical Presence in Other Countries
  – Campuses
  – Laboratories

• Strategic Alliances Between Universities

• Virtual Presence in Other Countries
  – Distance Education
    • Synchronous
    • Asynchronous
  – Open Content: The Emerging Meta-University
    • Teaching Materials
    • Scholarly Archives
    • Telepresent Laboratories
At MIT I became passionate about sharing knowledge.
At MIT I became passionate about sharing knowledge.

Because the Role of Universities is to Create Opportunity.
At MIT I became passionate about **sharing** knowledge.

Because the Role of Universities is to Create Opportunity.

And People Everywhere need Opportunity.
OpenCourseWare

We put the teaching materials for 2000 courses on the Web for anyone to use, anywhere, anytime, free of charge.
I learned that many people sought this knowledge.
From all over the world

% web hits since 10/1/03
And that they appreciated the knowledge:

/MIT OCW is the “8th Wonder of the World!” My Sincere Heartfelt Thanks to all of you our there who have been involved in the making of this project. Keep up the excellent work!

-- e-mail from Latvia Sept. 2002
Others think it is a good idea.
There are many other examples of freely or inexpensively available Libraries, Scholarly Materials, On-Line Education and even Web-accessible Laboratories.
In my view, this is all about openness as well as about sharing resources.
Openness in Higher Education …

• is the true spirit of education, democratization, and empowerment.

• underpins innovation, cooperation, and competition worldwide.

• enables sharing and accessing expensive and intellectually-intensive materials.

• speaks of institutional and national values.
Open Flow of Scientific Information is essential.

- Science thrives through unfettered communication.
- Science has an international culture.
- Science requires criticism, testing, and repetition.
And Now, … Open Flow of Educational Resources

• Not new, but …

• The Internet and Web introduce unprecedented
  – Scope
  – Reach
  – Speed
  – Interaction
I think something very fundamental is happening …
The Meta University

A Personal View

What we are observing is the early emergence of a *Meta University* -- a transcendent, accessible, empowering, dynamic, communally-constructed framework of open materials and platforms on which much of higher education worldwide can be constructed or enhanced.
The Meta University

- Will enable -- not replace -- residential campuses
- Will bring cost efficiencies to institutions through shared development;
- Will be adaptable -- not prescriptive;
- Will serve both teachers and learners;
- Will speed the propagation of high-quality education and scholarship;
- Will build capacity for economic development;
- Will build bridges across cultures and political boundaries; and
- Will be particularly important to the developing world.
Then came another Great Thought
With today’s computer and telecommunications technologies, every young person can have a quality education regardless of his or her place of birth.

MIT Professor Richard Larson
LINC
Learning International Networks Consortium

and

BLOSSOMS
Blended Learning Open Source Science or Math Studies
Bringing Partnership with Jordan, Pakistan, and Lebanon

Human/Technology interaction for learning

Learning Videos by volunteers
Let me relate this to the Grand Challenges project of the U.S. National Academy of Engineering (NAE)
GRAND CHALLENGES FOR ENGINEERING

MAKE SOLAR ENERGY ECONOMICAL PROVIDE ENERGY FROM FUSION DEVELOP CARBON SEQUESTRATION METHODS MANAGE THE NITROGEN CYCLE PROVIDE ACCESS TO CLEAN WATER RESTORE AND IMPROVE URBAN INFRASTRUCTURE ADVANCE HEALTH INFORMATICS ENGINEER BETTER MEDICINES REVERSE ENGINEER THE BRAIN PREVENT NUCLEAR TERROR SECURE CYBERSPACE ENHANCE VIRTUAL REALITY ADVANCE PERSONALIZED LEARNING ENGINEER THE TOOLS OF SCIENTIFIC DISCOVERY

INSPIRE

CHALLENGE

EDUCATE
Grand Challenges Committee

- Bill Perry, chair
- Sir Alec Broers
- Farouk El-Baz
- Wes Harris
- Bernadine Healy
- Daniel Hillis
- Calestous Juma
- Dean Kamen
- Ray Kurzweil
- Bob Langer
- Jaime Lerner
- Bindu Lohani
- Jane Lubchenco
- Mario Molina
- Larry Page
- Rob Socolow
- Craig Venter
- Jackie Ying
Engineering Grand Challenges

- Make Solar Energy Economical
- Manage the Nitrogen Cycle
- Advance Healthcare Informatics
- Prevent Nuclear Terror
- Advance Personalized Learning
- Provide Energy From Fusion
- Provide Access to Clean Water
- Engineer Better Medicines
- Secure Cyberspace
- Engineer the Tools of Scientific Discovery
- Develop Carbon Sequestration Methods
- Restore and Improve Urban Infrastructure
- Reverse Engineer the Brain
- Enhance Virtual Reality
Engineering Grand Challenges

www.engineeringchallenges.org

Energy
Environment
Global Warming
Sustainability

Reducing Vulnerability to Human and Natural Threats

Improve Medicine and Healthcare Delivery

Expand and Enhance Human Capability And Joy
INSPIRE

CHALLENGE

EDUCATE
GRAND CHALLENGES FOR ENGINEERING

WHY?

INSPIRE

CHALLENGE

EDUCATE
BECAUSE

Exciting Futures

Global Survival
Exciting Futures

For Our Children
Exciting Futures

Through Education and Innovation
This is the most exciting era in Engineering and Science in Human History.
Creating the Tools of Scientific Discovery
Reengineering the Brain
Making Solar Energy Economical
Global Survival

The Challenges are Profound.
Global Survival

and so are the opportunities.
Reducing Vulnerability to Human and Natural Threats

Expand and Enhance Human Capability And Joy
Reducing Vulnerability to Human and Natural Threats

Secure Cyberspace

Expand and Enhance Human Capability And Joy

Advance Personalized Learning

Restore and Improve Urban Infrastructure

Enhance Virtual Reality
I am an Optimist.
I am an Optimist.

If we can Learn together, we can meet Grand Challenges together.
LEARNING

PROBLEM SOLVING
LEARNING

THE DIGITAL WORLD

PROBLEM SOLVING

PEOPLE

IDEAS
I am an Optimist.

Because this is my view
Of he Future …
Then

Brain Drain
Brain Drain

Brain Circulation

Then

Now
Brain Drain

Brain Circulation

LINC

Brain Integration

Then

Now
LINCed
To Learn
Thank you.